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I. Solution by **JAMES F. LAWRENCE, A. B.**, Rogers Academy, Rogers, Ark.; **S. F. NORRIS**, Baltimore City College, Baltimore, Md.; and **G. B. M. ZERR, A. M., Ph. D.**, The Temple College, Philadelphia, Pa.

Let $a=256=$the contents of the cask.

$x=$the amount taken out at each draught, $=64$.

$a-x=$the amount of wine after first drawing.

$$\frac{a-x}{a}=\text{proportion of wine to each gallon of mixture.}$$

$$\frac{x(a-x)}{a}=\text{amount of wine drawn off at second drawing,}=48.$$

$$\frac{(a-x)^2}{a}=\text{amount of wine after second drawing.}$$

$$\frac{x(a-x)^2}{a^2}=\text{amount of wine drawn off at third drawing,}=36.$$

$$\frac{(a-x)^3}{a^2}=\text{amount of wine after third drawing.}$$

$$\frac{x(a-x)^3}{a^2}=\text{amount of wine drawn off at fourth drawing,}=27.$$

$$\frac{(a-x)^4}{a^3}=\text{amount of wine after fourth drawing.}$$

$b=$amount of wine after fourth drawing.

$$\therefore \frac{(a-x)^4}{a^3}=b. \quad a-x=\sqrt[4]{(a^3b)}. \quad x=a-\sqrt[4]{(a^3b)}=64.$$

Solved in like manner by *C. A. LINDEMANN*, *M. E. GRABER*, and *P. S. BERG*.
Professor Norris sent in a second solution which generalizes the following solution.

II. Solution by **D. B. NORTHRUP**, Mandana, N. Y., and the **PROPOSER**.

If one half of the wine is left after the first draught, of course one quarter is left after the second, one eighth after the third, and one sixteenth after the fourth. Hence the number of gallons left after the fourth draught divided by the whole quantity is the fourth power of the proportion left after the first draught. So the fourth root of $\frac{81}{256}=\frac{3}{4}$, the proportion left, and $\frac{1}{4}=64=$number of gallons first drawn, and 48, 36, and 27 the number at each of the other draughts.

ALGEBRA.

127. Proposed by **J. SCHEFFER, A. M.**, Hagerstown, Md.

Sum to n terms the series

$$\frac{4}{1.2.3}\cdot\frac{1}{3}+\frac{5}{2.3.4}\cdot\frac{1}{3^2}+\frac{6}{3.4.5}\cdot\frac{1}{3^2}+\cdots\cdot$$

Solution by G. B. M. ZERR, A. M., Ph. D., The Temple College, Philadelphia, Pa.; NELSON L. RORAY, Palmyra, N. Y., and the PROPOSER.

The general term $u_n=\dfrac{n+3}{n(n+1)(n+2)}\cdot\dfrac{1}{3^n}$.

$$u_n=\frac{1}{2n(n+1)}\cdot\frac{1}{3^{n-1}}-\frac{1}{2(n+1)(n+2)}\cdot\frac{1}{3^n}.$$

$$\therefore\ u_1=\frac{1}{2.2.1}-\frac{1}{2.2.3.3},$$

$$u_2=\frac{1}{2.2.3.3}-\frac{1}{2.3.4.3^2},$$

$$u_3=\frac{1}{2.3.4.3^2}-\frac{1}{2.4.5.3^3},$$

. . . .

$$u_n=\frac{1}{2n(n+1).3^{n-1}}-\frac{1}{2(n+1)(n+2).3^n}.$$

Adding, we get for the sum

$$S_n=\tfrac{1}{4}-\frac{1}{2(n+1)(n+2)}\cdot\frac{1}{3^n}.$$

Also solved by *ELMER SCHUYLER.*

128. Proposed by ELMER SCHUYLER, B. Sc., Teacher of German and Mathematics, Boys' High School, Reading, Pa.

Solve $(1+x^3)(1+x^2)(1+x)=30x^2$.

I. Solution by JOHN A. VAN GROOS, B. S., Graduate Student and Assistant in Mathematics, University of Oregon, Eugene, Ore.

$$(1+x^3)(4+x^2)(1+x)=30x^3\ \ldots.(1).$$

Writing the equation in the form

$$\left(x^3+\frac{1}{x^3}\right)+\left(x^2+\frac{1}{x^2}\right)+\left(x+\frac{1}{x}\right)=28,$$

by the theory of reciprocal equations, we have

$$v_3+v_2+v_1=28,\text{ where }v_3=z^3-3z,\ v_2=z^2-2,\ v_1=z=x+1/x.$$

Substituting these values, we have

$$z^3+z^2-2z-30=0.$$

By Newton's method of divisors we find that 3 is a root of this equation.

$\therefore\ (z-3)(z^2+4z+10)=0.\quad \therefore\ z=3,\ z=-2+\sqrt{(-6)},\ z=-2-\sqrt{(-6)}$.
Since $z=x+1/x$, we have